Fluidic Photomasking and Lithographic Refraction System

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Introduction

There are two aspects of the semiconductor chip fabrication process which greatly contribute to the complexity, cost and time involved in manufacturing chips. One of these is the need to construct photomasks which restrict the flow of LASER light only to the desired areas. Another complicating aspect is the need to mechanically actuate the chip in order to perform etching functions in each sub-region of a chip.

This paper will address itself to a proposal which could change the nature of photomasks and confer additional capabilities which would allow for lithography to be performed without needing to physically actuate chips during the etching process.

Abstract

In the publication of 17 November 2025, it was suggested by this author that lithography be performed upon chips submerged in a small quantity of distilled water in order to simplify the process of the removal of detritus between manufacturing steps; a costly process which wastes a great deal of water. This is increasingly problematical as semiconductor chip manufacturing plants are being constructed in places such as Arizona which feature water tables which are being rapidly depleted.

As long as we intend to submerge wafers in a fluid for this reason, it would make sense to explore other potential benefits of this approach.

Fluidic layers offer a potential means of refracting light in dynamical ways which could support multiple objectives, including photomasking and toward achieving the ideal of Zero-Actuation Lithography.

I propose that precision lithography can be achieved without a traditional photomask and without the actuation of the chip by submerging the chip in a minimum of three layers of fluids, each of which would feature different densities, with each fluid type floating upon the other due to their relatively decreased density/buoyancy. These layers would be used to conduct phononic energy in a direction parallel with the surface of the chip which would be introduced in order to create intra-layer density waves i.e. ripples. A single ripple in one layer in isolation would produce a slight refractory effect, but complementary ripples in multiple layers would introduce a more dramatic refractory effect. The use of even larger numbers of layers would allow for the refractory effect to be reversed before the beam arrives at the chip so that the angular momentum of the beam could be restored to its original relative angle, perpendicular with the chip. However, if an offset-angle strike meant to burrow below the surface of the chip was desired for some reason, this approach allows for that flexibility.

The final layer through which the beam travels would perform the photomasking step by focusing the beam toward a single point.

A computer would be able to accurately project the destination of a beam of light in any given set of ripple conditions and the position of the ripples could be anticipated by simply keeping track of the time since they were produced by the phononic system. The destination, or, ideally, the set of destinations, (as the goal would be to be able to create more than one transistor at a time,) of any beam could be verified using a low-intensity control beam which would have to be matched to the frequency of the lithographic pulse in the EUV band. The frequencies have to be matched for reason that lenses, fluidic or otherwise, will refract light to varying degrees depending upon frequency.

Variable Lithographic Beam Frequency

The ability to generate EUV light efficiently using the method prescribed in 28 October 2025 opens up the possibility of leveraging variable lithographic frequencies in conjunction with the fluidic refraction masking system in order to gain a greater degree of control over beam destination. It also opens up the possibility of operating many beams in parallel in order to achieve the fabrication of a single chip in a compact area.

Traditionally, chip manufacturers have been glad simply to be able to generate EUV pulses powerful enough to achieve lithography using a range of loosely-controlled EUV frequencies, but as we are talking about creating extremely small features in a wafer, to borrow a terminology from the world of painting, it is useful to have a wide variety of brush sizes available and to always use the right brush for the job.

The 28 October 2025 method of generating EUV light also brings with it the benefit that the minimum necessary level of power can be used to achieve the etching, which can not only reduce the amount of etching detritus generated, but can be leveraged to make the fluidic photomasking system more effective. By using the minimal necessary power to achieve etching, it makes it unnecessary to entirely block all light which might strike unintended zones. It is necessary only to mitigate the amount of light striking the non-target areas and the fluidic photomasking system can achieve this much.

Conclusion

Ultimately, such a system would be simpler, more flexible and cheaper to implement than the increasingly sophisticated photomasks in use in semiconductor manufacturing today.